

Customer behavior risk and the use of modern technologies in life insurance underwriting

Summary

Insurance activity is particularly related to the occurrence of risk, because the insurance institution was created to pay insurance benefits when certain events occur that are a consequence of the existence of risk. Risk occurs in insurance companies in almost every area of its activity, including the insurance risk assessment process and the use of modern technologies in underwriting. The analysis of the literature shows that there is no single definition of the concept of risk, and no one universal classification of risk has been created. For this reason, the concept of risk in life insurance has become the subject of analyzes and research undertaken in various scientific disciplines. The changes taking place in the modern economy and the insurance market, taking into account technological progress, justify the need for new directions of research in this area.

An important element in insurance activity is the underwriting process, which consists in estimating and classifying risk in order to accept it, including specifying the conditions for its acceptance or rejection by the insurance company. In order to properly identify and assess insurance risk, insurers use various underwriting tools. From the perspective of the insurance company, the underwriting process in life insurance is a key and current issue, due to the fact that the structure of the underwriting process affects the implementation of the assumed strategies regarding the quality of the insurance portfolio, premium adequacy, and consequently affects the insurance company's costs, profitability products and even the solvency of the insurer. The main purpose of underwriting is :

- preventing risk anti-selection. Anti-selection occurs when demand for insurance is made by people with an above-average risk of loss,
- ensuring the balance of the portfolio (more damaging risk categories should be compensated by less damaging ones), proper selection of the number of individual risk categories in the insurance portfolio, so that their total loss rate is not higher than

assumed, i.e. so that the future course of claims for a given group of insurance is close to the historical course, on the basis of which the insurance premium was determined,

- to ensure the profitability of carrying out insurance business.

The appearance of classic underwriting tools in the 19th century initiated the dissemination of the insurance risk assessment process and its subsequent evolution. The dynamic development of modern technologies in the 21st century contributed to the development and improvement of underwriting tools that supplemented or completely replaced their classic forms. In the area of life insurance, modern tools began to be used, which became key elements of holistic insurance risk assessment concepts based on modern technologies. Of particular importance here are modern sales and underwriting models such as pay as you live (PAYL), which use wearables technology to verify customer behavior and reward their health-promoting activities. Customers receive premium discounts in exchange for performing physical activity and achieving exercise goals. This concept of insurance fulfills a utilitarian function while promoting a healthy lifestyle. In addition, the compatibility of the PAYL model with smartphones, smartwatches and smart bands allows for direct data transfer from the client to the insurer. Nowadays, the digitization of the insurance sector is becoming a standard, and the digitization of underwriting tools can be a competitive advantage among insurance companies. Taking into account technological progress, it is also important to identify threats related to the use of modern risk assessment tools by insurers in order to effectively prevent or limit the materialization of this risk. Particularly important for the insurance company is the risk related to customer behavior, including their tendency to share data using modern technologies and related abuses. In life insurance, there is a lack of in-depth research on the risks associated with the use itself of modern technological solutions in the underwriting process. In addition, the dynamic nature of risk and changing trends in the use of modern technologies as well as changing social attitudes and generational differences regarding the willingness and motivation to share data with insurance companies affect the development and nature of underwriting processes used by insurers.

The subject of this dissertation is the risk related to customer behavior and generational differences resulting from the age of clients, during and in connection with the underwriting process carried out by an insurance company using modern technologies in life insurance. In this dissertation, customers' attitudes towards the use of modern technologies in life insurance, which imply the presence of customer behavioral risk in the insurance

company, are particularly important. Tendencies and motivations to share data with the insurer using modern technologies affect the level of this risk, but also whether the PAYL sales and underwriting model can be used at all, because the basic condition for using modern technologies in the PAYL model is the customer's consent to transfer to the insurance company of his data. The main data provided by customers to the insurer using applications in mobile devices are data on vital signs, physical activity, lifestyle and health.

The main purpose of this dissertation is to identify the types of risk associated with the use of modern technologies in life insurance underwriting and to identify customer characteristics that affect the willingness to share data with the insurer, their analysis along with belonging to generations. In order to achieve the main objective, sub-objectives were set in the form of identification of insurance risk factors in life insurance, analysis of the evolution of the risk assessment process and underwriting tools, analysis of the types and possibilities of using modern technologies in life insurance underwriting along with the risk associated with them, including depending on customer attitudes and generational differences.

The survey of customer attitudes was carried out on the basis of questionnaires conducted using an Internet form, using the CAWI (Computer Assisted Web Interview) method on a group of 906 people. Hypothesis testing, analysis of statistical differences and determination of statistical significance were performed using Pearson's chi-square test (χ^2). However, in order to determine the strength of the relationship, the V-Cramer convergence coefficient or F_i coefficient was calculated in the study. A survey was conducted to identify statistically significant relationships between the respondents' willingness to share with the insurer information on vital signs, physical activity, lifestyle, health status collected using mobile applications (at the stage of concluding the insurance contract and during the term of insurance cover), and the characteristics or attitudes declared by these respondents in their answers to the survey questions. Customer decisions about sharing data with insurers may vary. These decisions may result from the attitudes and characteristics of individual persons, as well as from the incentives offered by the insurance company in exchange for providing data. In this doctoral dissertation, the author formulated hypotheses related to the risk of customer behavior when using modern technologies in the underwriting process. As part of the observation of the risk of customer behavior and attitudes and their willingness to share data with the insurer using modern technologies, two research hypotheses were put forward:

- hypothesis H1: Belonging to an age group affects (in a statistically significant way) the willingness to share data on vital signs, physical activity, lifestyle, health condition with the use of mobile applications with a life insurance company in exchange for the possibility of lowering insurance premium at the stage of insurance purchase,

- hypothesis H2: The current use of modern technologies affects (in a statistically significant way) the willingness to share data on vital signs, physical activity, lifestyle, health status with the use of mobile applications with a life insurance company, in exchange for the possibility of reduction of the insurance premium at the stage of insurance purchase.

The dissertation has a theoretical and empirical character and consists of an introduction, four chapters and a conclusion.

Chapter I presents the essence and factors of insurance risk. Risk is an ambiguous and complex concept. In the doctoral dissertation various definitions of risk were presented. The word *risk* itself comes from the Old Italian *risicare*, which means to dare. According to P.L. Bernstein, risk is a choice rather than an inevitable destiny. The PWN Dictionary of Polish Language defines risk as an undertaking whose outcome is uncertain. It is also worth adding that the word risk in the Polish language is most often found in the singular, but you can also find its use in the plural, especially in the insurance industry, when referring, for example, to the possibility of several risks understood as several events. The first on the ground of economics attempted to give a definition of risk A.H. Willet in 1901, presenting in *The Economic Theory of Risk Insurance the economic theory of risk*. Willet, as a proponent of philosophical determinism, argued that risk is a measure of the degree of uncertainty resulting from imperfect knowledge of the laws governing external processes. He believed that risk is an objective correlate of subjective uncertainty. Willet's theory did not gain full acceptance, mainly due to the fact that uncertainty is not only due to imperfect knowledge. In contrast, Frank H. Knight defined risk as measurable uncertainty. Knight distinguished the term risk from the concept of uncertainty. The author argued that if the degree of uncertainty is known, it is no longer uncertainty. While risk is measurable, that is, it concerns future events whose probability of occurrence can be estimated, uncertainty cannot be approximated by statistical methods and is not subject to mathematical calculations. According to Pfeffer, on the other hand, risk is measured by probability, and uncertainty is measured by the degree of belief. Risk is a state of the real world, uncertainty is a state of mind. In Webster's dictionary, on the other hand, risk is defined as threat, danger, exposure to loss or damage. Holscher, on the

other hand, views risk through the prism of information asymmetry and believes that risk is the danger of not achieving the intended profit, resulting from having incomplete information. In the Polish economic literature one can also find attempts to define risk. For example, R. Dobbins and co-authors consider that risk refers to a situation in which at least one of the components is not known, but the probability of occurrence is known. A broad concept of risk is presented by J. Lopuski, stating that the term risk can be used in a variety of contexts, in which it is about expressing the possibility, and therefore measurable uncertainty of the occurrence of certain events and effects. However, T. Zaleśkiewicz and T. Tyszka clarify the essence of risk by distinguishing between choice under conditions of uncertainty and choice under conditions of risk. Regardless of which definition is adopted, it can be concluded that risk is related to two key concepts, i.e. the probability of occurrence and possible consequences (usually economic).

Next, medical risk in life insurance and non-medical risk (such as occupational risk, risk related to non-professional activity, financial risk and residence risk related to the geopolitical situation of the country where the client resides) were discussed in detail. Medical risk is paramount in the underwriting process in life insurance. The analysis of medical information for underwriting purposes is handled by insurance medicine, which includes epidemiology, diagnosis, treatment, and prognosis, and the related forecasting of the impact of various factors on life expectancy. Medical risk factors include age, gender, weight and height, smoking and alcohol/drug use, blood pressure, current and past illnesses, and hereditary (family) conditions.

At the end of the chapter, the origins and evolution of the underwriting process in life insurance was presented. Before underwriting reached its current level of development, it went through a long road of transformation and change. The history of the development of risk assessment systems for life insurance companies is described in detail by Z. Guzel-Szczypiórkowska with J. Visan and divide it into stages. Diagram 1 shows the evolution of underwriting by stage.

Diagram 1 Evolution of underwriting



Source: own elaboration based on literature review

In the first stage of the development of risk assessment systems that lasted until the end of the 19th century, preliminary questionnaires on the health history of the insured and his family and a description of his work were commonly used. In addition, references from two people known to the insurance company were required. Around 1870, medical examinations were introduced into insurance in the US market. They allowed a more accurate selection of insured risks. Initially, however, they were applied only to certain medical risks. At the end of the 19th century, American insurance companies began referring selected customers for urinalysis. In the second period (from the beginning of the 20th century), the medical-statistical stage began to pay attention to the relationship of individual risk factors to the mortality of insured persons. The resulting correlations sparked massive medical-actuarial analyses, where actuaries analyzed statistical data based on medical examinations of insured persons and identified correlations. Between 1885 and 1908, some 750,000 insured men and 400,000 women were surveyed in the US. The result of these studies was the division of the insured into risk classes according to their health status and the establishment of a list of 100 risky occupations. A detailed study of the effect of weight on insured mortality showed that the risk increased with overweight, and then further research led to finding a relationship between the height of blood pressure and mortality. Later use in research (for insurance purposes): ECG, X-ray, blood analysis allowed increasingly accurate assessment of those seeking insurance. In 1919, O. Rogers and A. Hunter of the New York Life Insurance Company presented a new method of risk assessment in their paper *Numerical Method for Determining Insurance Risk*. This method was based on comparing the probability of death in a given year between the weighted averages of two groups. The numerator was the observed group, the denominator the corresponding control group. The introduction of this system represented a revolution in the estimation of risk in life insurance, as well as making it possible to assess in detail the risk of death for particular disease entities previously uninsured (substandard risks).

In the third period - the clinical-actuarial stage - the numerical insurance risk assessment system was significantly developed for life insurance purposes. It was realized that it was becoming necessary to make greater use of prospective studies and current disease statistics collected at hospitals and clinics in place of historical data. Since the 1960s, more and more insurance companies have engaged in research programs to analyze the impact of internal and external factors on population mortality and morbidity. With advances in medical knowledge, it has become possible to further distinguish and classify the risks assumed and to monitor them more accurately. At present (stage IV of the evolution of underwriting), the progress of digitization and the availability of new electronic tools can be an opportunity for insurers and provides completely new opportunities to obtain data about an insurance candidate for use in risk assessment. Digitization, including the use of mobile applications, is a process that has been progressing for years in all sectors of the Polish, EU and global economy. However, the pace, level of development and priorities of digital transformation vary significantly for different industries and players involved.

Chapter II covers digitization in the economy and the insurance sector with the use of modern technologies. A significant part of the chapter was devoted to InsurTech solutions along with the Internet of Things, cloud computing, artificial intelligence, big data processing and blockchain technology. This chapter also discusses classic underwriting tools (insurance application, health declaration, medical questionnaire, medical examinations, additional medical and non-medical forms, financial documents) and modern tools used in life insurance underwriting (e.g. electronic devices, wearables, public data sources, social media, modern diagnostic techniques in medicine, automation of systems for assessing insurance risk and calculating premiums in life insurance with the use of technologies referred to in the previous sentence). In response to the insurance industry's demand, risk assessment has been automated, and automated underwriting systems are now available on the market that can assess and issue an insurance decision directly at the point of sale. Digitized underwriting tools are developed by teams of experts from various fields: underwriters, statisticians, actuaries, IT specialists, medical professionals, salespeople, customer service specialists, and reinsurers. These systems support all channels of insurance distribution, starting from stationary sales at an agent or broker's office, through sales in the bancassurance channel and via comparison sites, and ending with remote online or telephone sales. Modern underwriting tools can handle not only death insurance but also other protection insurance such as critical illness,

incapacity, disability, hospitalization, long-term care, etc. Modern underwriting systems, based on predetermined algorithms, are able to make a decision practically on the spot, immediately after the customer answers a few questions in the medical questionnaire. The advantage of automated underwriting tools is their consistency and transparency. This chapter has been additionally enriched with considerations on the types of risk to which an insurance company is exposed in connection with the use of modern technologies in the underwriting process in life insurance, i.e. legal risk, technological risk and financial risk.

Chapter III contains considerations on the clients behavioral risk related in connection with the use of modern technologies in the underwriting process in life insurance. From the insurance company's perspective, behavioral risk can be perceived through the behavior of customers related to signing an insurance contract. From the point of view of this dissertation, the client's behavior during the underwriting process, is particularly important. This includes customer behavior towards underwriting tools used by the insurer, customer attitude to modern technologies and their willingness (including generational differences) to share data with the insurance company, as well as a tendency to abuse and committing insurance crimes. The classification of generations is presented in Table 1.

Table 1 Classification of generations based on a literature review:

Author	Generation	Year of birth of representatives of the generation
J. Chicca, T. Shellenbarger (2018)	Generation Y	1980 - 1995
	Generation Z	1995 - 2012
E.S. Lakatos, and others (2018)	Generation X	1965 - 1980
	Generation Y	1980 - 2000
	Generation Z	after 2000
E.A. Brown, N.J. Thomas, R.H. Bosselman (2015)	Sages	1925 - 1945
	Baby Boomers	1946 - 1964
	Generation X	1965 - 1980
	Generation Y	1981 - 2000
M. Dimock (2019)	Silent Generation	1928 - 1945
	Boomers	1946 - 1964
	Generation X	1965 - 1980
	Millenials	1981 - 1996
	Generation Z	1997 - 2012

B. Chomątowska, A. Żarczyńska-Dobiesz (2014)	Baby Boomers	1946 - 1964
	Generation X	1965 - 1976
	Generation Y	1977 - 1990
	Generation Z	after 1990
S. David, J. Kandampully, A. Kralj (2012)	Baby Boomers	1946 - 1964
	Generation X	1965 - 1978
	Generation Y	1979 - 1994
E. Goh, C. Lee (2018)	Baby Boomers	1945 - 1964
	Generation X	1965 - 1979
	Generation Y	1980 - 1998
	Generation Z	1995 - 2009
M. Cho, M.A. Bonn, S.J. Han (2018)	Generation Y	1977 - 1994
	Generation Z	1995 - 2002
M. Ozkan, B. Solmaz (2015)	Silent Generation	1925 - 1944
	Baby increment	1945 - 1964
	Generation X	1965 - 1979
	Generation Y	1980 - 2000
	Generation Z	after 2000

Source: Own elaboration based on Pay as You Live and New Technologies in Life Insurance Underwriting in the Context of Generational Characteristic and Attitudes – Evidence from Poland, Vision 2025: Education Excellence and Management of Innovations through Sustainable Economic Competitive Advantage, 2020, p. 10795

Based on the above summary, the author of the dissertation decided to use the following classification of generations in the study, which is the most frequently used division:

- generation "S" - represented by people who were born before 1960,
- generation "X" - people born in 1960 - 1980,
- generation "Y" - represented by people born in the years 1981 - 1995,
- generation "Z" - people born after 1995.

After discussing the differences between generations in the area of behavior and decision-making, the issue of asymmetry of information in the context of the insurance risk assessment process carried out by an insurance company was discussed, and the phenomenon of insurance crime and moral hazard was discussed.

Chapter IV is empirical. It presents the results of a survey in terms of willingness and motivation to share data with a life insurance company using mobile devices. A statistical description of the survey results and statistical dependencies between the characteristics of clients and their willingness to share with the insurer information on vital signs, physical

activity, lifestyle, health condition, using applications in electronic devices (at the stage of purchasing insurance and during the term of insurance cover) were presented. The study summary presents the results of the verification of the research hypotheses along with the conclusions. There were also references and comparisons to studies conducted by other research centers and presentation of recommendations for insurance companies based on the results of the own study. The research shows that 52% of all respondents would agree to provide insurance companies with data on their vital signs, health, physical activity and lifestyle collected via using mobile applications on a smartphone, smartwatch or smart band in exchange for the possibility of lowering the insurance premium before purchasing life insurance. However, during the term of insurance coverage, consent to monitoring by insurance company using the mobile application of vital signs, physical activity, lifestyle, health condition, would be expressed by 42% of all respondents, i.e. by 10 p.p. less.

In the survey, both research hypotheses were accepted. This means, firstly, that belonging to an age group influences (statistically significant) to the willingness to share data on vital parameters, physical activity, lifestyle, health condition, using mobile applications, with a life insurance company, in exchange for the possibility of lowering the insurance premium at the stage of purchasing insurance. Motivation of the respondents as to their willingness to share the above-mentioned data with the insurance company using mobile applications on a smartphone, smartwatch or smart band, in exchange for the possibility of lowering the insurance premium, decreases with age. The approval for sharing data for age groups was respectively: 58.05% (generation "Z"), 50.77% (generation "Y"), 47.44% (generation "X"), 43.14% (generation "S"). Secondly, it has been proven that the current use of modern technologies affects (in a statistically significant way) the willingness to share data on vital parameters, physical activity, lifestyle, health status with the use of mobile applications with a life insurance company, in return for the possibility of lowering the insurance premium at the stage of insurance purchase. The study showed that when buying insurance, people who use modern technologies on a daily basis would be more willing to consent to share data with the insurance company (65.45%) in exchange for the possibility of lowering the insurance premium, compared to people who would agree to share data but not use modern technologies on a daily basis (45.96%). In order to verify the H2 hypothesis, among the respondents, a group of people using modern technologies was distinguished and it was assumed that the group of people using modern technologies included both respondents who

use both a smartphone and a smartwatch (or smart band) on a daily basis. On the basis of such grouping, Pearson's χ^2 test of independence was performed. The calculations showed statistically significant correlation between the variables both at the stage of insurance purchase ($\chi^2=29.15988$, $p=.00000$, $F_i=.1794026$) and during the insurance period ($\chi^2=47.24819$, $p=.00000$, $F_i = -.228364$).

Adoption of the hypotheses put forward in the dissertation makes it possible to formulate recommendations for insurance companies in terms of determining the target customer group for life insurance offers distributed and sold in the pay as you live model. Representatives of the "Z" generation (born after 1995) and the "Y" generation (born in the years 1981 - 1995), people who use modern technologies on a daily basis, i.e. smartwatches and smart wristbands connected via applications with smartphones, should become a key customer segment (target) of life insurance sales, in which underwriting will be carried out with the use of modern technologies. Other groups are a challenge and, at the same time, a potential for insurance companies as a group above which should be further analysed, especially in the context of identifying and promoting the benefits for customers of sharing data with the insurance company, as well as mitigating concerns related to the transfer of data.

The analysis of the results of the conducted research also showed significant correlations between various characteristics of the respondents, with their inclinations to share data with the insurance company (on vital signs, health, activity physical and lifestyle data collected using mobile applications in a smartphone, smartwatch or smart band), at the stage of purchasing insurance and during the term of insurance cover. There is a statistically significant correlation between the willingness to share data with the insurer (in the field of vital signs, physical activity, lifestyle, health condition), at the stage of purchasing life insurance, with the following variables: age, type of work, willingness to purchase life insurance, using a smartwatch or smart band, using pay as you drive motor insurance offers available in mobile applications, using mobile applications (on a smartphone, smartwatch or smart band recording such data as e.g. physical activity, sports, vital signs such as heart rate, respiratory rate or sleep analysis, level of activity during leisure time, frequency of sports practiced, smoking cigarettes), other types of data shared (such as: history of spending from the bank account, timely repayment of credit obligations, breaks in employment, political views) and with the willingness to share data with the insurer (on vital signs, health, physical

activity and lifestyle collected using mobile applications in a smartphone, smartwatch or smart band) during the term of insurance cover. In addition, at the stage of purchasing insurance, there is a statistical correlation between the willingness to share data with the insurance company, with aggregated variables such as: lifestyle and the use of modern technologies. The results of independence test between the willingness to share data with the insurer, before purchasing life insurance, with selected parameters, are presented in Table 2.

Table 2 Test of independence between the willingness to share data (in the field of vital signs, physical activity, lifestyle, health condition) with the insurer, before purchasing life insurance, with selected parameters

The correlation between the willingness to share data with the insurer before purchasing life insurance with the following variables:	χ^2 test value	P-value for the χ^2 test	Cramer's V/ Fi for 2x2 tables
Gender	1,100012	,29426	Fi= -,034845
Age	17,44589	,04217	V= ,1387658
Education	2,573372	,46218	V= ,0532951
Domicile	1,131922	,88917	V= ,0353463
Marital status	4,199798	,37964	V= ,0680848
Having children	3,028111	,08183	Fi= -,057813
Type of work	11,11710	,04911	V= ,1107724
Net monthly income per person	2,084755	,95500	V= ,0479693
Having life insurance	,2625690	,60836	Fi= -,017024
Purchasing life insurance	27,00455	,00000	Fi= -,172645
Using the Internet	,4145681	,51966	Fi= -,021391
Using a smartphone	1,535718	,21526	Fi= -,041171
Using a smartwatch or smartband	29,85527	,00000	Fi= ,1815292
Using pay as you drive motor insurance offers available in mobile applications	45,71450	,00000	Fi= ,2246275
Using mobile applications (on a smartphone, smartwatch or smartband) that record data such as physical activity, sports, vital signs (such as heart rate, respiratory rate) or sleep analysis	30,48560	,00000	Fi= ,1834355
Leisure activity level	20,65107	,00037	V= ,1509758
Frequency of practiced sport	29,30084	,00005	V= ,1798357

The occurrence of diseases	,1707180	,67947	Fi= -,013727
Smoking	6,943470	,00841	Fi= -,087544
BMI	7,282511	,20046	V= ,0896554

Source: Own elaboration based on the Statistica program

During the insurance period, the following factors remained statistically significant: the willingness to buy life insurance, the use of a smartwatch or smart band, the use of pay as you drive motor insurance offers available in mobile applications, the use of mobile applications (smartphone, smartwatch or smart band, recording data such as physical activity, sports, vital parameters such as heart rate, respiratory rate or sleep analysis), activity level during leisure time, frequency of sports practiced, smoking, other types of shared data (such as: history of spending from a bank account, timeliness of loan repayments, breaks in employment, political views) and the willingness to share data with the insurer (on vital signs, health, physical activity and lifestyle collected using mobile applications in a smartphone, smartwatch or smart band) at the stage of purchasing insurance. Compared to the stage of purchasing insurance, factors such as age and type of work are not statistically significant during the coverage period. On the other hand, statistically significant variables, so far absent in connection with the sharing of data with the insurer at the stage of purchasing insurance, and which appeared only at the stage of the protection period, are: marital status, having children and having life insurance. The results of independence test between the consent to the monitoring of data by the insurance company, during the term of insurance cover, with selected parameters, are presented in Table 3.

Table 3 Test of independence between the consent to the monitoring of data (in the field of vital signs, physical activity, lifestyle, health condition) by the insurance company, during the term of insurance cover, with selected parameters.

The correlation between the willingness to share data with the insurer during the life insurance period with the following variables:	χ^2 test value	P-value for the χ^2 test	Cramer's V/ Fi for 2x2 tables
Gender	1,728587	,18859	Fi= ,0436799
Age	15,16066	,08662	V= ,1293585
Education	8,464571	,03733	V= ,0966581

Domicile	4,516655	,34058	V= ,0706064
Marital status	22,33287	,00017	V= ,1570031
Having children	32,86230	,00000	Fi= ,1904517
Type of work	13,22319	,02137	V= ,1208103
Net monthly income per person	12,48206	,08578	V= ,1173759
Having life insurance	9,810807	,00173	Fi= ,1040611
Purchasing life insurance	44,85104	,00000	Fi= ,2224960
Using the Internet	,0827106	,77366	Fi= ,0095547
Using a smartphone	1,190404	,27525	Fi= ,0362479
Using a smartwatch or smartband	46,32044	,00000	Fi= -,226111
Using pay as you drive motor insurance offers available in mobile applications	73,38324	,00000	Fi= -,284600
Using mobile applications (on a smartphone, smartwatch or smartband) that record data such as physical activity, sports, vital signs (such as heart rate, respiratory rate) or sleep analysis	44,40628	,00000	Fi= -,221390
Leisure activity level	45,50574	,00000	V= ,2241140
Frequency of practiced sport	45,93308	,00000	V= ,2251639
The occurrence of diseases	2,161846	,14147	Fi= ,0488482
Smoking	5,886474	,01526	Fi= ,0806053
BMI	7,378552	,19397	V= ,0902447

Source: Own elaboration based on the Statistica program

It should also be emphasized that the strongest correlation ($\chi^2 = 293.47$, $p = 0$, $Fi = -.569140$) among all the examined variables was observed between the willingness to share data with the insurer (on vital signs, health, physical activity and lifestyle of the collected using mobile applications on a smartphone, smartwatch or smart band) at the stage of purchasing insurance, with the willingness to share the same data during the term of insurance coverage as part of monitoring by the insurer.

In addition, the correlation between the types of data provided to the insurer was checked. The results of the analysis indicate that people who would decide to provide the insurer with information on the history of expenses from the bank account, timeliness of loan

repayments, breaks in employment and political views - would also provide information on vital signs, health, physical activity and lifestyle both at the stage of purchasing insurance, as well as during its duration (Table 4).

Table 4 Test of independence between the types of data made available to the insurer

The correlation between the types of data shared	Bank account spending history	Timely repayment of loan repayments	Employment breaks	Political views
Providing data on vital signs, health, physical activity and lifestyle at the stage of purchasing insurance	$\chi^2=108,5629$ Wartość p dla testu $\chi^2=0$ Fi= ,3461598	$\chi^2=128,4619$ Wartość p dla testu $\chi^2=0$ Fi= ,3765504	$\chi^2=142,3998$ Wartość p dla testu $\chi^2=0$ Fi= -,396452	$\chi^2=98,16693$ Wartość p dla testu $\chi^2=0$ Fi= ,3291687
Providing data on vital signs, health, physical activity and lifestyle as part of monitoring by the insurer during the insurance period	$\chi^2=91,08106$ Wartość p dla testu $\chi^2=0$ Fi= -,317066	$\chi^2=66,66631$ Wartość p dla testu $\chi^2=0$ Fi= -,271262	$\chi^2=73,51327$ Wartość p dla testu $\chi^2=0$ Fi= ,2848517	$\chi^2=95,36536$ Wartość p dla testu $\chi^2=0$ Fi= -,324438

Source: Own elaboration based on the Statistica program

It is worth pointing out that research on the phenomenon of risk associated with the use of modern technologies in insurance and the tendency of customers to share data with the insurer is of interest to scientists around the world, including also in Poland. However, it can be said that until the dissertation was written, there was no study that would scientifically and comprehensively attempt to analyze the issue of the risk of using modern technologies in the underwriting process in life insurance, taking into account the risk associated with customer behavior and the problem of willingness to share data with the insurer, significant from the point of view of insurance risk assessment. However, there are still many issues within this research area that require further work and in-depth research. For example, a survey conducted by the author showed that there are groups of people (representatives of the "S" and "X" generations and people who do not use modern technologies on a daily basis with the use of applications in smartphones, smartwatches and smart bands), which groups can be a potential for insurance companies, on which further analysis and research should be

carried out, in particular in the context of identifying and promoting the benefits for these customers resulting from the sharing of data with insurance companies, as well as mitigating concerns related to the transfer of data. Further scientific research should also be conducted in the field of technological risk and analysis in the area of increasingly new examples of behavioral risk associated with customer behavior in the form of modern forms of insurance fraud and crime.